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Unraveling the Story of the Black Scorpionfish (*Scorpaena porcus* Linnaeus, 1758): Exploring Local Ecological Knowledge and the Exploitative History of a Marine Species

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Abstract: In the Mediterranean Sea, and in marine areas worldwide, for most locations, data on species presence and abundance are generally poor or non-existent. When available, these data are generally reported only at small scale and/or for short temporal series. In this study, the investigation of abundance and size trends, along with some ecological aspects of the data-poor species *Scorpaena porcus*, commonly known as the Black Scorpionfish, was undertaken using FEK (Fishers' Ecological Knowledge). The results clearly indicated a sharp reduction in both abundance and size over the last 21 years (2001–2021) of this species in the central Mediterranean Sea. The causes of this decline, and the importance of FEK, as well as Local Ecological Knowledge (LEK), in research and the assessment and management of biological resources are discussed.

Keywords: Scorpaenidae; fisheries; Mediterranean Sea; overfishing; fishers' ecological knowledge

Key Contribution: The research reveals a substantial decline in both the catch and average size of *Scorpaena porcus* over a 21-year period (2001–2021). Fishermen unanimously attribute the decline in *S. porcus* to fishing activities, with professional fishermen acknowledging the role of their own practices, emphasizing the urgent need for comprehensive management strategies that go beyond conventional fisheries' management to preserve this species and its associated marine ecosystems.

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1. Introduction

Fishing activities have long been a major source of impact on marine coastal environments and their associated species, representing both historical and significant influence. Overfishing has led to the global depletion of local populations and several species [1,2]. In the absence of long-term data, scientists and the general public may face a loss of collective memory, potentially leading to misconceptions about the status of ecosystems and past ecological conditions. This phenomenon, described by Pauly in 1995 as the "shifting baseline syndrome", was initially noted among fisheries scientists [3]. These scientists perceived the condition they observed early in their careers as a "natural" baseline for stock size and composition, but failed to incorporate past and historical data. In a broader context, this occurs when a given generation uses as a baseline for evaluating future changes, based on the ecosystem's state that was present at the start of their lifetimes (or career in the case of scientists). In other words, this corresponds to the erroneous perception of a current state of an ecosystem due to inappropriate information about its past conditions [4].

In the case of fisheries, the lack of historical data can lead to the use of inappropriate reference points in ecosystems' assessment and for the evaluation of species' abundances and diversity over time. The effects of a shifting baseline are even greater for most marine areas because data on habitat and species' presence and abundance are scarce or absent [5–8].

The Local Ecological Knowledge (LEK) of fishers can be used to reconstruct trends of species' abundance over time, hence representing a valid tool to integrate new data into the gaps left by conventional studies conducted by researchers [9–11]. Indeed, fishers have great knowledge of the biological resources they exploit and of the environment in which they work. In this case, the concept of FEK (Fishers' Ecological Knowledge) may be used, and is defined as the fishers' environmental knowledge of local resources, developed through the interaction between fishers and the aquatic environment with its biological components [12–15]. Therefore, the use of FEK and LEK concepts can be of fundamental importance to define solid historical baselines of the environmental conditions of aquatic systems, and play a key complementary role to traditional research by detecting long-term changes regarding the ecosystem (presence/abundance of species, fishing yields, species' ecology and behavior).

The Black Scorpionfish, *Scorpaena porcus* Linnaeus, 1758, is a relatively small benthic fish with a robust body. Its total length typically ranges from 15 to 20 cm. This species is distributed in the eastern Atlantic (from British Isles to the Azores, Canary Islands and Morocco) and in the Mediterranean and Black Sea [16,17]. *Scorpaena porcus* typically shows a dark coloration, featuring various shades of brown, red and black, which provide effective camouflage in its habitat, represented by shallow hard and mixed bottoms, where it is often observed close to rocks, on sand or hiding among rocks and boulders [18]. It is a voracious ambush predator that mainly feeds on crustaceans and small fishes [19,20]. In the Mediterranean Sea, this species represents a target species for both professional (coastal artisanal fisheries operating with trammel nets and gillnets) and recreational (with spearguns) fishing activities, and is considered a valuable species for fish soup [21]. However, despite its importance and diffusion in marine environments, catch data for this species are generally scarce or lacking.

This study aims to investigate the abundance trend of *S. porcus* over the last 21 years (2001–2021) using FEK in southeastern Sicily (central Mediterranean Sea, Ionian Sea), reconstructing the history of this species from a time when it was very common and abundant to a period where the species became rare. The possible reasons for its decline and some ecological aspects have also been investigated, and the importance of FEK in fisheries science is discussed in this paper.

2. Materials and Methods

The reasons for starting this study and constructing and administering specific questionnaires lie in my personal perception and experience, and in the unstructured interviews of fishermen that raised the issue of the sharp decline of the Black Scorpionfish in the Sicilian Ionian Sea. In particular, in my close contact with local fishermen and through 19 years of spearfishing practice, I have noticed a significant decrease in the presence of this species.

A total of 53 fishermen (34 professionals—trammel nets, and 19 recreational—speargun) with at least 21 years of experience and operating between Syracuse and Marzamemi (Sicilian Ionian Sea), along a coastline of about 40 km, were interviewed between May and August 2021. Four other professional fishermen with the same characteristics (using trammel nets and with at least 20 years of experience) were interviewed on 18 September 2021 in Pantelleria (Strait of Sicily), a small island between Sicily and Tunisia, which is located about 285 km from the main study area in Sicily (Figure 1). Before starting the questionnaires, I asked each fisherman if he operates along coastal waters in which the Black Scorpionfish is present; if he operates in the same fishing ground, and with gears with the same technical characteristics over the 21 years investigated; and if the species represents a target species. The questionnaires were completed only if all responses were positive. The questionnaires were conducted individually (face-to-face and by phone) in order to avoid any external influence. Each participant was made aware of the purpose of the research and verbal consent was obtained. Furthermore, in order to strengthen our

data, I asked to professional fishermen if they had any notes about past catches. In some cases, these data were available, and agreed with those reported by local fishmongers.

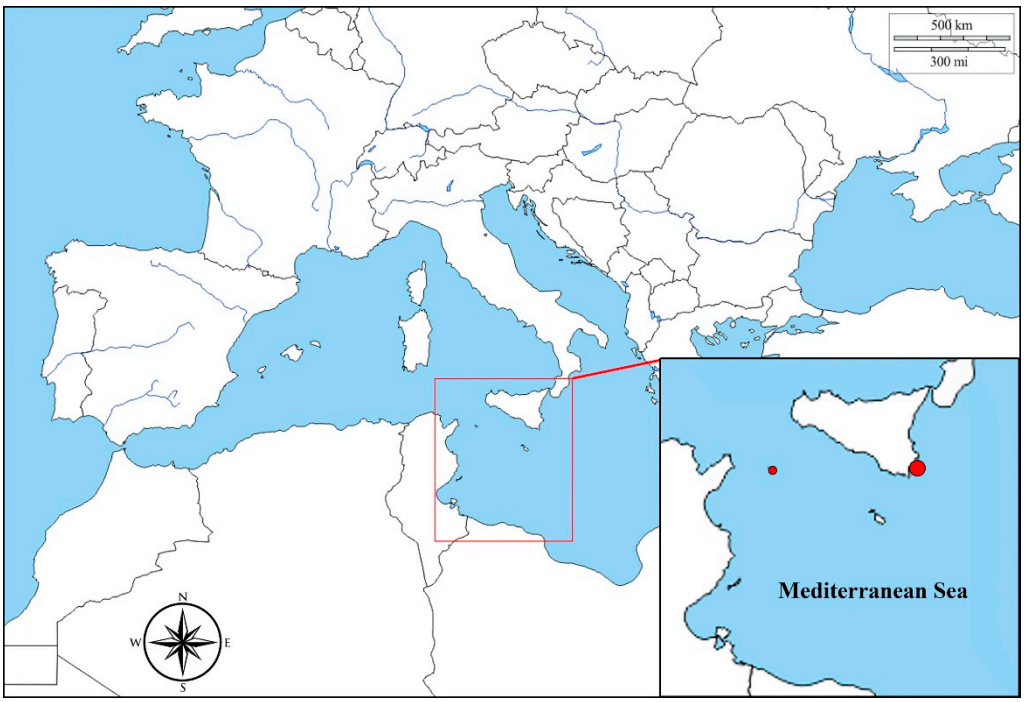

Figure 1. Study areas (red circles) in the central Mediterranean Sea: Ionian Sea (larger circle) and Strait of Sicily (smaller circle).

The questionnaire included both open and closed questions (13 in total), aiming to evaluate the following points: the years of fishing activity; the mean number of individuals per day of *S. porcus* in 2001, 2011 and 2021; the maximum number of individuals per day in 2001, 2011 and 2021; the medium size (total length—TL in cm) of *S. porcus* in 2001 and 2021; the depth range where the species is usually caught; the habitat in which the species is usually caught; the economic (professional fishermen)/sporting (recreational fishermen) value of *S. porcus* (low, medium, high); and the causes of the decline of *S. porcus*. The sporting value of a fish species increases with the level of difficulty in catching it. This difficulty depends on various factors, such as the animal's swimming ability and its ability to hide or camouflage itself or to live in difficult-to-access habitats, etc.

Unlike recreational fishermen, professional fishermen were better at remembering *S. porcus* catches in kg/fishing day than specimens/fishing day. Hence, in order to standardize the data, we converted kg in number of specimens considering the average weight of a specimens equal to 150 g (1 kg = 6.6 specimens).

The size changes between 2001 and 2021 for each category of fishermen were tested using a paired t-test ($\alpha = 0.01$). The same was conducted to test the differences for the same periods (2001 and 2021) between the medium size reported by professional and recreational fishermen. The observed abundance (mean and maximum) between the past and the present for each category was tested using a one-way ANOVA with a Geisser-Greenhouse correction ($\alpha = 0.01$). Results concerning the variable "habitat" and "bathymetric range" were considered to come from the single general category of fishermen, with no distinction between "professional" and "recreational" fishermen.

3. Results

Interviewed professional fishermen had a mean experience of 27.6 years (SD = 3.5), while recreational fishermen had that of 23.3 years (SD = 2.6).

A clear statistical difference was found in catches between the three different periods investigated (2001, 2011 and 2021) for both categories of fishermen: professional ($p < 0.01$;

F = 94.79; df = 37) and recreational ($p < 0.01$; F = 61.88; df = 18). For professional fishermen, the mean catches sharply decreased from 62 to 4 specimens per fishing day over 21 years (Figure 2, Table 1). For the same category, the maximum catches also sharply decreased from 187 to 29 specimens per fishing day in the same period (Figure 2, Table 1). A similar trend, although with lower absolute values, was also evident for recreational fishermen: the mean catches sharply decreased from four to one specimen per fishing day over 21 years, and the maximum catches sharply decreased from seven to three specimens per fishing day in the same period (Figure 2, Table 1).

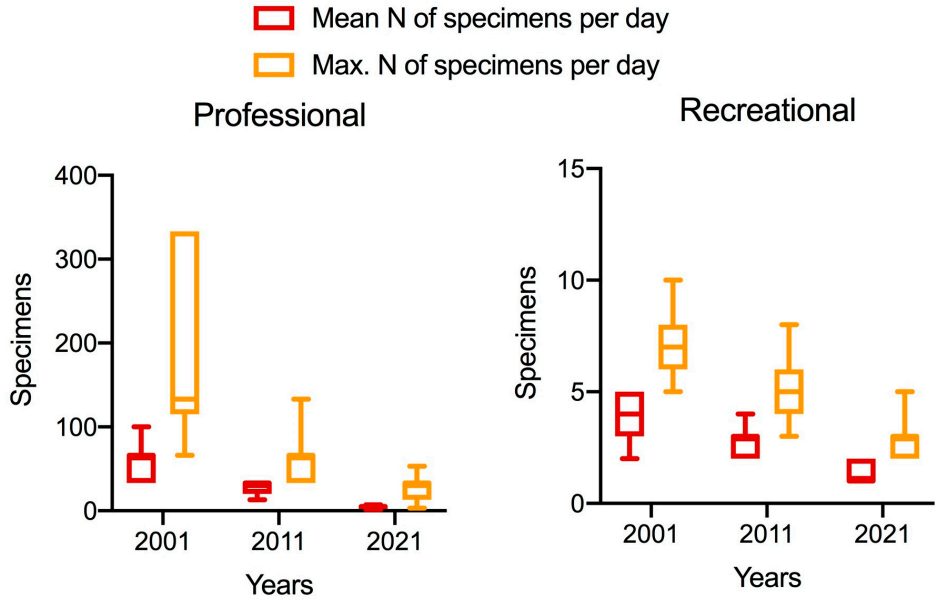

Figure 2. Box plots of catches of *Scorpaena porcus* over the last 21 years (2001–2021) for professional (**left**) and recreational (**right**) fishermen. Values are expressed as number of specimens; N = number (abundance of specimens).

Table 1. Professional and recreational catches and mean size (TL in cm) data for *Scorpanea porcus* over the last 21 years (2001–2021); SD = standard deviation; range = minimum and maximum values recorded.

Professional						
	Mean specimens per day			Max. specimens per day		
Period	Range	Mean	SD	Range	Mean	SD
2001	33–100	61.82	22.21	66–333	187.42	104.79
2011	13–33	28.13	7.96	33–133	67.95	37.13
2021	1–7	4.10	1.91	3–53	29.08	13.91
Recreational						
	Mean specimens per day			Max. specimens per day		
Period	Range	Mean	SD	Range	Mean	SD
2001	2–5	3.90	1.05	5–10	7.31	1.60
2011	2–4	2.74	0.65	3–8	5.00	1.33
2021	1–2	1.26	0.45	2–5	2.84	0.83
Mean size of *Scorpaena porcus*						
	Professional fishermen			Recreational fishermen		
Period	Range	Mean	SD	Range	Mean	SD
2001	15–25	18.63	2.61	15–25	18.26	3.26
2021	10–20	13.90	2.79	10–20	14.05	2.55

A clear statistical difference was obtained in comparing the medium size of *S. porcus* specimens caught in 2001 (~18.4 cm TL) with those caught in 2021 (~13.9 cm TL) for both categories: professional ($p < 0.01$; t = 14.73; df = 37) and recreational ($p < 0.01$; t = 5.359, df = 18). Meanwhile, no statistical differences were found in comparing the medium size of *S. porcus* reported by professional and recreational fishermen for the same periods: 2001 ($p = 0.651$; t = 0.461; df = 56) and 2021 ($p = 0.795$; t = 0.2642, df = 56) (Figure 3, Table 1). In a period of 21 years, we have registered a general size reduction in the medium size of *S. porcus* equal to ~4.5 cm in TL (Table 1).

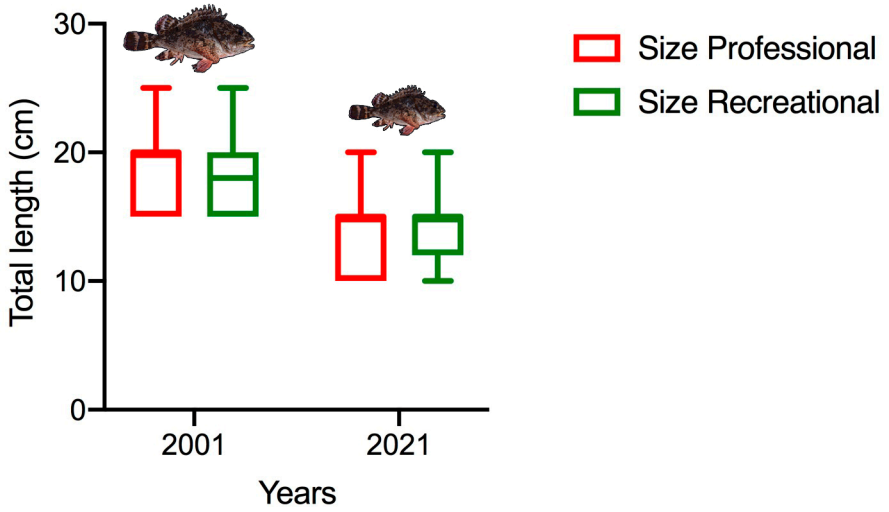

Figure 3. Box plots of size of *Scorpaena porcus* for professional and recreational fishermen in 2001 and 2021. The median (middle quartile) is indicated by the horizontal line that divided the box in two parts; the middle "box" represents the middle 50% scores for the group. The area between lower to upper quartile is referred to as the inter-quartile range; the upper and lower whiskers represent scores outside the middle 50%.

The species was mainly caught on rocky substrates (54.4%), followed by mixed bottoms (sand and rocks) with the presence of *Posidonia oceanica* (L.) Delile (28.1%) and mixed bottoms, in which *P. oceanica* meadows were absent (17.5%) (Figure 4). *Scorpaena porcus* was caught within a depth range of 0.5–40 m. Most of the professional fishermen (73.6%) declared a "medium" economic value for *S. porcus*, followed by "high" and "low" values (both 13.2%). For most of the recreational fishermen (73.7%), *S. porcus* had a "low" sporting value, followed by a "medium" sporting value (26.3%). According to professional fishermen, the main cause (55.3%) of the species' decline is due to fishing activities in general (professional and recreational), while others (23.7%) point to their own professional activity, pointing out that it is the irresponsible use of small mesh sizes that is destructive. A much smaller number of professional fishermen pointed instead to spearfishing (7.9%) and habitat destruction (5.2%), while another 7.9% found no clear explanation. On the other hand, 52.6% of recreational fishermen consider professional fishing activities to be the main cause for the decline of *S. porcus*, while others mention fishing activities in general (professional and recreational) (21.1%), spearfishing (10.5%) and habitat destruction (5.3%), and another 10.5% of recreational fishermen found no clear explanation for the decline of the species (Figure 5).

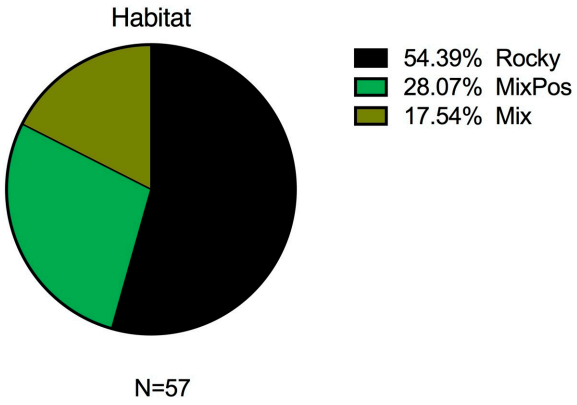

Figure 4. Substrate type on which *S. porcus* is usually caught for both categories (professional and recreational); Rocky = rocky bottom; MixPos = mixed bottom with rocks and sand and patches of *Posidonia oceanica*; Mix = mixed bottom with rocks and sand.

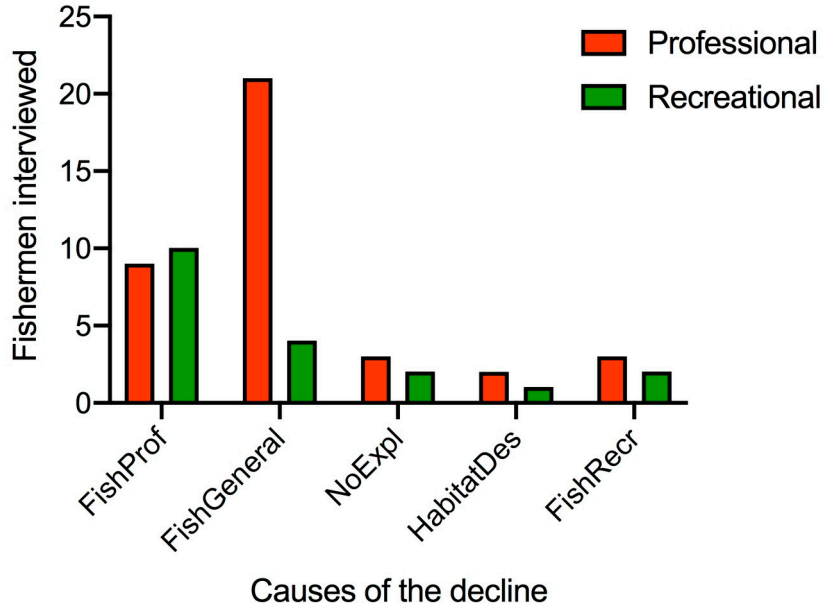

Figure 5. Causes of the decline of *S. porcus* in the opinion of fishermen; FishProf = professional fishery; FishGeneral = fishery in general; NoExpl = no explanation; HabitatDes = habitat destruction; FishRecr = recreational fishery.

4. Discussion

The analysis of interview results clearly indicated, according to the opinions and historical memory of both categories (professional and recreational fishermen), a sharp decrease in *S. porcus* catches over 21 years, from 2001 to 2021. Considering the mean catches per day of professional fishermen, we recorded a reduction of more than 50% in the first 10 years of the period investigated (from 2001 to 2011), and a further and more marked reduction (~85%) in the last 10 years investigated (until 2021). Currently, professional fishermen catch on average only a few specimens per day (with zero specimens in some fishing days), compared to in 2001, when they caught on average several dozen fish per day. A similar trend, with obviously lower absolute numbers, was recorded also for recreational fishermen, who, in 2021, caught on average one specimen per fishing day (as opposed to four specimens in 2001). A sharp decrease was also observed by both categories of fishermen for the maximum catches of *S. porcus* in 21 years, from 2001 to 2021. While, in the past, professional fishermen were able to catch an average maximum number of 187 specimens per day, today the average maximum number is equal to 29, with a reduction of ~84.5%. A minor but still significant reduction was observed for recreational fishermen,

who have gone from an average maximum number of seven specimens per day to three specimens per day in 21 years, with a reduction of ~57.2%. It is therefore clear how the abundance of *S. porcus* markedly decreased during the 21 years investigated. This sharp decline is particularly significant if we consider that professional fishermen, due to the general decrease in marine biological resources over the years, have increased the length of the trammel nets used in order to compensate for this general decrease, and have increased the overall amount of biological resources caught.

Moreover, during interviews, local fishermen have brought to my attention that other species, which have been historically significant for both professional and recreational fisheries, such as *Scorpaena scrofa* Linnaeus, 1758, *Labrus merula* Linnaeus, 1758 and *Labrus viridis* Linnaeus, 1758, were not only more abundant but also tended to reach larger sizes in the past. This observation hints at potential shifts in the dynamics of these marine populations over time. Moreover, this is particularly relevant if we consider how both categories (professional and recreational) of interviewed fishermen had more than 20 years of experience.

On the other hand, amidst these changes, fishermen have also pointed out a noticeable surge in the population of the Madeira rockfish, *Scorpaena maderensis* Valenciennes, 1833 in recent years. Notably, *S. maderensis* is a smaller scorpionfish, with a maximum total length in the area reaching only 13.1 cm. Intriguingly, this species holds no commercial or recreational interest, yet it shares a habitat and ecological traits with *S. porcus* [22,23]. The upward trend in *S. maderensis* numbers might be attributed to a combination of factors that are not mutually exclusive: 1. It is plausible that the decline in *S. porcus* has resulted in a greater availability of trophic resources, potentially creating a partially empty ecological niche that *S. maderensis* is capitalizing on; 2. The lower fishing mortality for *S. maderensis* could be due to its smaller body size, making it less susceptible to capture with trammel nets or gillnets, and its lack of appeal to spearfishermen; 3. The observed warming of the Mediterranean Sea may be favoring *S. maderensis*, given its adaptation to warmer waters [24]. These shifts in the relative abundance of different scorpionfish species not only offer valuable insights into the ecological dynamics of the region, but also underscore the intricate interplay of environmental, ecological and anthropogenic factors shaping the marine ecosystem.

Both categories of fishermen unanimously reported a decrease in the average size of *S. porcus* over time, with specimens caught in 2001 being notably larger (approximately 4.5 cm in TL more) than those caught in 2021. There was a consensus among both categories regarding the average size of *S. porcus* in 2001 and 2021. This alignment reinforces the reliability of LEK and affirms that both categories possess a keen perception of the historical and current medium size of the fish under investigation. The observed size reduction of *S. porcus* over time is likely attributed to the impacts of fishing activities, a suggestion consistent with findings by other author for various species [25]. However, other factors such as water warming cannot be dismissed, and might contribute, at least in part, to the decrease in fish body size, as proposed by some researchers [26,27]. Notably, this phenomenon appears to predominantly affect small-bodied species.

Scorpaena porcus was caught in shallow coastal waters, mainly on rocky bottoms, but also on mixed bottoms (sand and rocks) with and without the presence of *P. oceanica*. For most professional fishermen, *S. porcus* has a medium economic value that contributed in the past, when the species was abundant, to the overall earnings from fishing activities. On the other hand, for most recreational fishermen using spearguns, this species has a low sporting value, being a benthic species with low mobility. Indeed, the only major difficulty in capturing this cryptic species lies in finding it when it is camouflaged on the substrate. Nevertheless, they declared that they are excited to capture it, as the species is highly appreciated for its taste in fish soup. Considering the causes of the decline of the species during the 21-year period investigated, both categories agree to the fact that fishing activities are the main cause, but while most of the professional fishermen accused fishing activities in general, most of the recreational fishermen accused professional fishing

activities. Furthermore, a good percentage of professional fishermen accuse their own professional fishing activity, with the irresponsible use of small meshes and excessive length of the nets. Hence, fishing activities, and in particular professional ones, are perceived as the main cause of the sharp decline of *S. porcus*. Considering the territoriality of *S. porcus*, it is plausible that continuous fishing activities have caused a marked decline of the species [28,29]. Although professional fishing has certainly had a greater impact on the species, considering the number of specimens captured, recreational fishing with spearguns could have had a bigger impact in very shallow waters, in which trammel nets (and gillnets) are usually not used. Moreover, it is worth noting that recreational fishing with spearguns is largely unregulated in many countries, making it difficult to determine the exact number of participants and the extent of their catches. Consequently, even a relatively small group of four–five individuals, when multiplied across potentially hundreds or thousands of recreational fishermen, could have a significant impact on the local fish population.

The conspicuous decline observed in the Black Scorpionfish population and size can be predominantly ascribed to the impacts of fishing activities, casting a broad net over both professional and recreational sectors. Notably, the influence of professional fishing appears particularly noteworthy, potentially exerting a more profound effect on this benthic shallow-water species. This significant reduction underscores the vulnerability inherent in the life history and ecological dynamics of *S. porcus*. As a species dependent on specific habitats and exhibiting a limited capacity for rapid population recovery, the consequences of its overexploitation become especially pronounced. The urgency of this matter necessitates a re-evaluation and enhancement of our current management strategies. The heightened susceptibility of *S. porcus* calls for an integrative approach that goes beyond conventional fishery management. Strategies such as habitat protection, seasonal closures and adaptive management measures need to be considered and implemented. Moreover, involving local communities and stakeholders in the decision-making process can enhance the effectiveness of these strategies and foster a sense of shared responsibility for the sustainable management of this species. In recognizing the broader ecological implications, our findings advocate not only for the preservation of *S. porcus*, but also for the safeguarding of the intricate web of marine ecosystems it inhabits. Addressing the decline in this species is not merely an isolated concern; it is a call to action for the preservation of biodiversity, the maintenance of ecological balance and the sustainable use of our marine resources.

Considering the importance of FEK for the management of fishery resources, the involvement of fishers in decision-making processes should be held in high regard [5,6,30], hence the importance of establishing a dialogue between them and scientists. In this regard, the FAO has also expressed the need to involve and recognize fishermen and their experience in decision-making processes, and to support specific programs in favor of fishing communities' knowledge [31]. For most species (especially for those of artisanal and recreational fisheries), catch data are generally scarce or absent, but thanks to the use of FEK, it is possible to reconstruct historical trends in species' abundance and distribution before these are completely lost to posterity [32,33]. This is also the case of the current study on *S. porcus*, a species about which we have limited knowledge regarding its exploitation, presence and abundance along our national (Italian) and Mediterranean coasts, and for which, thanks to this research, some gaps for specific areas and periods have been filled. It then becomes clear how the loss of the local and indigenous knowledges in general can have serious consequences for the effective conservation and management of biodiversity [34,35]. Hence, the experience and knowledge of fishermen can be very important in fisheries' management, and should be included as a supplementary tool in traditional fishery research. Furthermore, a closer collaboration and interaction between fishermen and researchers is of fundamental importance to have the confidence of fishermen in order to improve the amount and quality of data obtained and to make them feel involved in research and conservation efforts.

In a landscape where numerous conservation objectives demand fulfillment, Local Ecological Knowledge (LEK) emerges as a valuable contributor to a multidisciplinary

conservation approach, fostering even transdisciplinary strategies when local communities are engaged as active partners and collaborators. Recognized as a pivotal component for the success of any management system dedicated to sustaining local resources [36], it becomes imperative to channel heightened efforts into developing methodologies that effectively quantify changes in LEK [37]. Furthermore, there is a pressing need to comprehensively document LEK before it undergoes transformation or, worse, is completely lost [38,39]. Unfortunately, this is already happening, and has happened for many species.

It is essential to conduct additional research on the evolution of knowledge in diverse local contexts. The scarcity of LEK research in developed nations may introduce bias into our perceptions and assumptions about what is often labeled "residual" or as "pockets of knowledge", dismissing them as obsolete in the face of modernization. Much like how the depletion of biodiversity leaves our world biologically impoverished, the erosion of local and indigenous knowledge contributes to a socio-cultural impoverishment. These two interconnected processes amplify each other, leading to increasingly adverse consequences for conservation efforts. Therefore, endeavors should extend beyond safeguarding biodiversity alone, encompassing a commitment to the preservation of indigenous peoples and their intricate knowledge systems.

5. Conclusions

Utilizing Fishers' Ecological Knowledge (FEK), this study has demonstrated a significant decline in both the population and size of the Black Scorpionfish over the past two decades in Sicilian waters. It is worth emphasizing that this situation is likely to be similar in other Mediterranean areas as well. This marked reduction is primarily attributable to fishing activities, with professional fishing exerting a potentially more pronounced impact. This underscores the vulnerability of *S. porcus* as a benthic shallow-water species, emphasizing the urgent necessity for enhanced management strategies.

In light of our findings, *S. porcus* emerges as a species warranting careful attention to prevent further depletion. Effective management practices, including potential fishing restrictions and habitat conservation measures, become imperative for the preservation of this ecologically important species.

Furthermore, our study underscores the pivotal role of gaining a comprehensive understanding of the historical status of biological resources. Such insights not only enhance our scientific knowledge but also serve as a powerful tool in raising public awareness regarding the critical importance of preserving natural resources and ecosystems. Recognizing the significance of combining Local Ecological Knowledge (LEK) with conventional scientific studies and data further emerges as a crucial approach. This integration promises a more holistic and nuanced comprehension of the present state of biological resources and ecosystems, providing a foundation for informed conservation and sustainable management practices.

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Institutional Review Board Statement: Ethical review and approval are not necessary for this study because no specimens were collected and treated in any manner.

Informed Consent Statement: During the administration of the questionnaires, all participants, including the interviewed fishermen, were fully informed about critical aspects of the research. Firstly, complete anonymity of the participants was assured. Secondly, the purpose of the research was clearly communicated, aiming to investigate the decline in catches of *Scorpaena porcus* and its implications for both professional and recreational fishing in the Sicilian Ionian Sea. Participants were also informed about the use of the collected data, which will solely be for scientific analysis and academic publication, ensuring the confidentiality of personal information. Lastly, a comprehensive explanation was provided regarding potential risks associated with participation, emphasizing the sensitive nature of information concerning fishing practices and habits. Participants freely and knowingly consented to take part in the study, demonstrating their understanding and acceptance of all the aforementioned

points. This informed consent process was implemented to ensure transparency, confidentiality and respect for the participants involved in the research.

Data Availability Statement: Data will be made available on request.

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Conflicts of Interest: The author declares no conflict of interest.

References

1. Bender, M.G.; Machado, G.R.; Silva, P.J.A.S.; Floeter, S.R.; Monteiro-Netto, C.; Luiz, O.J.; Ferreira, C.E.L. Local ecological knowledge and scientific data reveal overexploitation by multigear fisheries in the southwestern Atlantic. *PLoS ONE* **2014**, *9*, e110332. [CrossRef]
2. Rosenberg, A.A. Managing to the margins: The overexploitation of fisheries. *Front. Ecol. Environ.* **2003**, *1*, 102–106. [CrossRef]
3. Pauly, D. Anecdotes and the shifting baseline syndrome of fisheries. *Trends Ecol. Evol.* **1995**, *10*, 430. [CrossRef] [PubMed]
4. Kahn, P.H.; Friedman, B. Environmental views and values of children in an inner-city black community. *Child. Dev.* **1995**, *66*, 1403–1417. [CrossRef]
5. Veneroni, B.; Fernandes, P.G. Fishers' knowledge detects ecological decay in the Mediterranean Sea. *Ambio* **2021**, *50*, 1159–1171. [CrossRef]
6. Beaudreau, A.H.; Levin, P.S. Advancing the use of local ecological knowledge for assessing data-poor species in coastal ecosystems. *Ecol. Appl.* **2014**, *24*, 244–256. [CrossRef]
7. Huntington, H.P. Using traditional ecological knowledge in science: Methods and applications. *Ecol. Appl.* **2000**, *10*, 1270–1274. [CrossRef]
8. Moller, H.; Berkes, F.; Lyver, P.O.B.; Kislalioglu, M. Combining science and traditional ecological knowledge: Monitoring populations for co-management. *Ecol. Soc.* **2005**, *9*, 2. [CrossRef]
9. Azzurro, E.; Sbragaglia, V.; Cerri, J.; Bariche, M.; Bolognini, L.; Ben Souissi, J.; Busoni, G.; Coco, S.; Chryssanthi, A.; Fanelli, E.; et al. Climate change, biological invasions, and the shifting distribution of Mediterranean fishes: A large-scale survey based on local ecological knowledge. *Glob. Change Biol.* **2019**, *25*, 2779–2792. [CrossRef]
10. Azzurro, E.; Moschella, P.; Maynou, F. Tracking signals of change in Mediterranean fish diversity based on local ecological knowledge. *PLoS ONE* **2011**, *6*, e24885. [CrossRef]
11. Farr, E.R.; Stoll, J.S.; Beitl, C.M. Effects of fisheries management on local ecological knowledge. *Ecol. Soc.* **2018**, *23*, 15. [CrossRef]
12. Manzan, M.F.; Lopes, P.F.M. The behavior of the estuarine dolphin (*Sotalia guianensis*, van Bénéden, 1864) according to fishermen from different fishing environments. *Ocean Coast. Manag.* **2016**, *130*, 229–238. [CrossRef]
13. Manzan, M.F.; Lopes, P.F.M. Fishers' knowledge as a source of information about the estuarine dolphin (*Sotalia guianensis*, van Bénéden, 1864). *Environ. Monit. Assess.* **2015**, *187*, 4096. [CrossRef]
14. Lima, M.S.P.; Lins Oliveira, J.E.; de Nóbrega, M.F.; Lopes, P.F.M. The use of Local Ecological Knowledge as a complementary approach to understand the temporal and spatial patterns of fishery resources distribution. *J. Ethnobiol. Ethnomed.* **2017**, *13*, 30. [CrossRef] [PubMed]
15. Lopes, P.F.M.; Verba, J.T.; Begossi, A.; Pennino, M.G. Predicting species distribution from fishers' local ecological knowledge: A new alternative for data-poor management. *Can. J. Fish Aquat.* **2018**, *76*, 8. [CrossRef]
16. Bilgin, S.; Çelik, E.S. Age, growth and reproduction of the black scorpionfish, *Scorpaena porcus* (Pisces, Scorpaenidae), on the Black Sea coast of Turkey. *J. Appl. Ichthyol.* **2009**, *25*, 55–60. [CrossRef]
17. Froese, R.; Pauly, D. FishBase. Available online: https://www.fishbase.org (accessed on 9 November 2021).
18. Pashkov, A.N.; Shevchenko, N.F.; Oven, L.S.; Giragosov, V.E.; Kruglov, M.V. Distribution, numbers, and principal population indexes of *Scorpaena porcus* under anthropogenic pollution of the Black Sea. *J. Ichthyol.* **1999**, *39*, 634–641.
19. Başçınar, N.S.; Sağlam, H. Feeding habits of black scorpionfish *Scorpaena porcus*, in the southeastern Black Sea. *Turk. J. Fish. Aquat. Sci.* **2009**, *9*, 99–103.
20. Sahin, C.; Erbay, M.; Kalayci, F.; Ceylan, Y.; Yesilcicek, T. Life-history traits of the Black Scorpionfish (*Scorpaena porcus*) in the southeastern Black Sea. *Turk. J. Fish. Aquat. Sci.* **2018**, *19*, 571–584. [CrossRef]
21. Koca, H.U. A study on the determination of some parameters of the scorpion fish (*Scorpaena porcus* Linne., 1758) caught by bottom nets in the area of Sinop in terms of fishery biology. *Turk. J. Vet. Anim. Sci.* **2002**, *26*, 65–69.
22. La Mesa, M.; La Mesa, G.; Micalizzi, M. Age and growth of madeira scorpionfish, *Scorpaena maderensis* Valenciennes, 1883, in the central Mediterranean. *Fish. Res.* **2005**, *74*, 265–272. [CrossRef]
23. La Mesa, G.; La Mesa, M.; Tomassetti, P. Feeding habits of the Madeira rockfish *Scorpaena maderensis* from central Mediterranean Sea. *Mar. Biol.* **2007**, *150*, 1313–1320. [CrossRef]
24. Rafrafi-Nouira, S.; Golani, D.; Capapé, C. First records of Madeira rockfish *Scorpaena maderensis* (Osteichthyes: Scorpaenidae) from the Tunisian coast (central Mediterranean). *Acta Adriat.* **2018**, *59*, 231–236. [CrossRef]

25. Mohd Yusoff, N.I.S.; Mat Jaafar, T.N.A.; Vilasri, V.; Mohd Nor, S.A.; Seah, Y.G.; Habib, A.; Wong, L.L.; Danish-Daniel, M.; Sung, Y.Y.; Mazlan, A.G.; et al. Genetic diversity, population structure and historical demography of the two-spined yellowtail stargazer (*Uranoscopus cognatus*). *Sci. Rep.* **2021**, *11*, 13357. [CrossRef] [PubMed]
26. Audzijonyte, A.; Richards, S.A.; Stuart-Smith, R.D.; Pecl, G.; Edgar, G.J.; Barrett, N.S.; Payne, N.; Blanchard, J.L. Fish body sizes change with temperature but not all species shrink with warming. *Nat. Ecol. Evol.* **2020**, *4*, 809–814. [CrossRef] [PubMed]
27. Verberk, W.C.E.P.; Atkinson, D.; Hoefnagel, K.N.; Hirst, A.G.; Horne, C.R.; Siepel, H. Shrinking body sizes in response to warming: Explanations for the temperature-size rule with special emphasis on the role of oxygen. *Biol. Rev.* **2020**, *96*, 247–268. [CrossRef]
28. Özgül, A.; Lök, A.; Tanrikul, T.T.; Alós, J. Home range and residency of *Scorpaena porcus* and *Scorpaena scrofa* in artificial reefs revealed by fine-scale acoustic tracking. *Fish. Res.* **2019**, *210*, 22–30. [CrossRef]
29. Colloca, F.; Scarcella, G.; Libralato, S. Recent trends and impacts of fisheries exploitation on Mediterranean stocks and ecosystems. *Front. Mar. Sci.* **2017**, *4*, 244. [CrossRef]
30. Colloca, F.; Carrozzi, V.; Simonetti, A.; Di Lorenzo, M. Using local ecological knowledge of fishers to reconstruct abundance trends in elasmobranchs populations in the Strait of Sicily. *Front. Mar. Sci.* **2020**, *7*, 508. [CrossRef]
31. FAO. *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication*; FAO: Rome, Italy, 2015; 34p.
32. Tiralongo, F.; Messina, G.; Lombardo, B.M. Discards of elasmobranchs in a trammel net fishery targeting cuttlefish, *Sepia officinalis* Linnaeus, 1758, along the coast of Sicily (central Mediterranean Sea). *Reg. Stud. Mar. Sci.* **2018**, *20*, 60–63. [CrossRef]
33. Ruano-Chamorro, C.; Subida, M.D.; Fernández, M. Fishers' perception: An alternative source of information to assess the data-poor benthic small-scale artisanal fisheries of central Chile. *Ocean Coast. Manag.* **2017**, *146*, 67–76. [CrossRef]
34. Aswani, S.; Lemahieu, A.; Sauer, W.H. Global trends of local ecological knowledge and future implications. *PLoS ONE* **2018**, *13*, e0195440. [CrossRef]
35. Early-Capistrán, M.M.; Solana-Arellano, E.; Abreu-Grobois, F.A.; Narchi, N.E.; Garibay-Melo, G.; Seminoff, J.A.; Koch, V.; Saenz-Arroyo, A. Quantifying local ecological knowledge to model historical abundance of long-lived, heavily-exploited fauna. *PeerJ* **2020**, *8*, e9494. [CrossRef] [PubMed]
36. Pfund, J.-L.; Watts, J.D.; Boissière, M.; Boucard, A.; Bullock, R.M.; Ekadinata, A.; Dewi, S.; Feintrenie, L.; Levang, P.; Rantala, S.; et al. Understanding and integrating local perceptions of trees and forests into incentives for sustainable landscape management. *Environ. Manag.* **2011**, *48*, 334–349. [CrossRef] [PubMed]
37. Fernández-Llamazares, Á.; Díaz-Reviriego, I.; Luz, A.C.; Cabeza, M.; Pyhälä, A.; Reyes-García, V. Rapid ecosystem change challenges the adaptative capacity of local environmental knowledge. *Glob. Environ. Chang.* **2015**, *31*, 272–284. [CrossRef]
38. Badshah, L.; Hussain, F. People preferences and use of local medicinal flora in District Tank, Pakistan. *J. Med. Plants Res.* **2011**, *5*, 22–29. [CrossRef]
39. Mbaye, A.; Cormier-Salem, M.-C.; Schmidt, J.O.; Brehmer, P. Senegalese artisanal fishers in the apprehension of changes of the marine environment: A universal knowledge? *Soc. Sci. Humanit. Open* **2021**, *4*, 100231. [CrossRef]